Claims:

What is claimed is:

1. A diboride single crystal substrate that is a single crystal substrate of diboride XB_2 (where X is either Zr or Ti), characterized in that the substrate is facially oriented in a (0001) plane and has a thickness of 0.1 mm or less.

2. A diboride single crystal substrate as set forth in claim 1, characterized in that the substrate has an orientation flat indicating a (10-10) or (11-20) plane.

3. A semiconductor laser diode, characterized in that it is formed on a substrate of diboride XB_2 single crystal where X is either Zr or Ti and that the substrate is facially oriented in a (0001) plane of the single crystal.

4. A semiconductor laser diode as set forth in claim 3, characterized in that the semiconductor laser diode formed on the diboride XB_2 single crystal substrate has a multilayered active layer, that the diboride XB_2 single crystal substrate has cut faces each lying along a (10-10) plane thereof, and that the multilayered active layer has a pair of opposed end faces constituting a semiconductor laser light resonator which are formed by cleavage faces lying parallel to the (10-10) plane of the diboride XB_2 single crystal substrate.

5. A semiconductor laser diode as set forth in claim 3 or claim 4, characterized in that the diboride XB_2 single crystal substrate has a thickness of 0.1 mm or less.

6. A semiconductor laser diode as set forth in any one of claims 3 to 5, characterized in that the diboride XB_2 single crystal substrate is a ZrB_2 single crystal substrate, and that the multilayered active layer of the semiconductor laser diode comprises a nitride compound semiconductor ($Al_xGa_yIn_zN$ where $x + y + z = 1$).

7. A semiconductor device that is formed on a substrate of a diboride XB_2 single crystal (where X is Zr or Ti) which is facially oriented in a (0001) plane of the single crystal, characterized in that:

the diboride XB_2 single crystal substrate has a pair of cut faces resulting from cutting a said substrate upon scribing it with a diamond pen or the like along a (10-10) plane; and

a semiconductor device constituting the device has side faces at least one of which is parallel to the (10-10) plane of the diboride XB_2 single crystal substrate.

8. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is a semiconductor laser diode.

9. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is a light emitting diode.

10. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is a photo detector.

11. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is a heterojunction bipolar transistor.

12. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is a field effect transistor.

13. A semiconductor device as set forth in claim 7, characterized in that the semiconductor device is an integrated circuit.

14. A semiconductor device as set forth in any one of claims 7

to 13, characterized in that the diboride XB_2 single crystal substrate has a thickness of 0.1 mm or less.

15. A semiconductor device as set forth in any one of claims 7 to 14, characterized in that the diboride XB_2 single crystal substrate is a ZrB_2 single crystal substrate and the semiconductor device comprises a nitride compound semiconductor ($Al_xGa_yIn_zN$ where $x + y + z = 1$).

16. A method of making a semiconductor laser diode, characterized in that it comprises the steps of:

forming active layers of the semiconductor laser diode on a substrate of a diboride XB_2 single crystal (where X is Zr or Ti) that is facially oriented in a (0001) plane of the single crystal; and

scribing the diboride XB_2 single crystal substrate along a (10-10) plane thereof and cutting the semiconductor device's active layers together with the substrate into a plurality of their divisions each individually constituting a semiconductor laser diode.

17. A method of making a semiconductor laser diode as set forth in claim 16, characterized in that prior to the step of scribing the diboride XB_2 single crystal substrate along a (10-10) plane thereof and cutting the semiconductor device's active layers together with the substrate into a plurality of their divisions, the method further includes the step of thinning the diboride XB_2 single crystal substrate to 0.1 mm or less in thickness.

18. A method of making a semiconductor laser diode as set forth in claim 16, characterized in that the diboride XB_2 single crystal substrate is thinned to a thickness of 0.1 mm or less.

19. A method of making a semiconductor laser diode as set forth in any one of claims 16 to 18, characterized in that the diboride XB_2 single crystal substrate is a ZrB_2 single crystal substrate and the semiconductor laser diode has multiple active layers made of a nitride

compound semiconductor ($Al_xGa_yIn_zN$ where x + y + z = 1).

20. A method of making a semiconductor device, characterized in that it comprises the steps of:

forming a semiconductor device on a substrate of a diboride XB_2 single crystal (where X is either Zr or Ti) that is facially oriented in a (0001) plane of the single crystal; and

dividing the semiconductor device on the diboride XB_2 single crystal substrate by cutting the device parallel to a (10-10) plane of the diboride XB_2 single crystal substrate.

21. A method of making a semiconductor device as set forth in claim 20, characterized in that the step of cutting the device comprises cleaving.

22. A method of making a semiconductor device as set forth in claim 20 or claim 21, characterized in that prior to the step of dividing the semiconductor device on the diboride XB_2 single crystal substrate by cutting the device parallel to a (10-10) plane of the diboride XB_2 single crystal substrate, the method further comprises the step of thinning the diboride XB_2 single crystal substrate to 0.1 mm or less in thickness.

23. A method of making a semiconductor device as set forth in claim 20 or claim 21, characterized in that the diboride XB_2 single crystal substrate is thinned to a thickness of 0.1 mm or less.

24. A method of making a semiconductor device as set forth in any one of claims 20 to 23, characterized in that the diboride XB_2 single crystal substrate is a ZrB_2 single crystal substrate and the semiconductor device is made of a nitride compound semiconductor ($Al_xGa_yIn_zN$ where x + y + z = 1).